INSTALLATION AND OPERATION MANUAL

HS-6N, HS-12N

6/12-Channel High Speed Data Modules

Megaplex-2100/2104 Version 12, Megaplex-4100 Version 1.2

RAD
data communications
Innovative Access Solutions

HS-6N, HS-12N

6/12-Channel High Speed Data Modules

Megaplex-2100/2104 Version 12, Megaplex-4100 Version 1.2

Installation and Operation Manual

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Quick Start Guide

If you are familiar with the HS-6N and HS-12N modules, use this guide to prepare the module for operation.

1. Preparation for Operation

Insert the module in the prescribed I/O slot.

Connect the prescribed cables to the module CH connectors, in accordance with the site installation plan.

2. Configuration Procedure

To configure the desired HS-6N or HS-12N channel in the MP-2100/2104 chassis, use the command:

DEF CH SS CC

where **SS** is the slot number, and **CC** is the channel number (1 to 6 for HS-6N, and 1 to 12 for HS-12N).

To configure the desired HS-6N or HS-12N channel in the MP-4100 chassis, use the **Configuration>Physical Ports>I/O** screen.

Configuration parameters and the range of values are listed in the following table.

Parameter	Range of Values
Connect*	YES **NO**
Admin Status**	UP **DOWN**
Rate	nx64kbps or nx56kbps, where: n **= 1** to 31 for E1 links n **= 1** to 24 for T1 links RS-232 interface: only **64 kbps**
Clock Mode	**DCE** EXTERNAL DCE DTE

Parameter	Range of Values
CTS	**ON**
	RTS
FIFO Size	**AUTOMATIC**
	16 BITS
	30 BITS
	52 BITS
	72 BITS
BRD SRC CH*	**NONE**
	EX1 to EX6 (HS-6N)
	EX1 to EX12 (HS-12N)
Operation Mode	**BI-DIR**
	UNI-BRD TX
	UNI-BRD RX
	BID-BRD RX*
	BID-BRD RING*
ML Slot*	**IO-1** up to the maximum supported by the chassis
ML Channel*	**EX1** up to the maximum supported by the selected main link module
Destination Slot**	CLX, IO-1 to IO-10, **-**
Destination Port**	1 to 8 for external ports
	1 to 63 (1 to 84) for internal (virtual) PDH ports
	NONE
Map Type	**N/A**
	USER
	SEQUENCE
Start TS	**N/A**
	1 to 31 for E1 links
	1 to 24 for T1 links

* MP-2100/2104 only

** MP-4100 only

3. Assigning Timeslots

Assign the uplink bandwidth to each connected channel as follows:

- When using the **BI-DIR, UNI-BRD TX** or **BID-BRD RING** mode in the module installed in the MP-2100/2104 chassis, use the **DEF TS** command as explained in the *Megaplex-2100/2104 Installation and Operation Manual*. For the module installed in the MP-4100 chassis, use the **Configuration>System>TS Assignment** screen.
- When using the **UNI-BRD RX** or **BID-BRD RX** mode in the module installed in the MP-2100/2104 chassis, timeslot assignment for the receive direction is made using the dedicated routing fields of the **DEF CH** command. For the module installed in the MP-4100 chassis, use the **Configuration>Physical ports>IO** screen.

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Chapter 1
Introduction

1.1 Overview

This manual describes the technical characteristics, applications, installation and operation of the HS-6N and HS-12N 6/12 high-speed data modules for use in Megaplex-2100, Megaplex-2104, and Megaplex-4100 integrated access multiplexers.

Versions

The HS-6N and HS-12N modules can be ordered in the following versions, which differ with respect to the type of channel interface:

- Modules with V.11/RS-422 channel interfaces. These versions support user's equipment with RS-530, V.36/RS-449, and X.21 physical interfaces.
- Modules with V.35 channel interfaces, for connection to user's equipment with V.35 interfaces.
- Modules with RS-232 channel interfaces, for connection to user's equipment with RS-232 interfaces.

Each version is available in two models:

- HS-12N: module with 12 independent channels
- HS-6N: module with 6 independent channels.

Note *In this manual, the generic term **Megaplex** is used when the information is applicable to all the three Megaplex chassis. The complete designation is used only for information applicable to a specific equipment version.*

Main Features

The HS-6N and HS-12N modules support 6 or 12 high-speed synchronous data channels, respectively.

Each channel can be independently configured to operate at a data rate of n×56 or n×64 kbps, where n = 1 to 24 when the channel is routed to a T1 link, and 1 to 31 (that is, maximum 1984 kbps) when the channel is routed to an E1 link.

Note *Modules with RS-232 interfaces support only 64 kbps.*

Data rates are independently selectable for each channel. The only restrictions are as follows:

- The combined data rates of a pair of consecutive channels (i.e., 1 and 2; 3 and 4; etc.) cannot exceed 1984 kbps
- You can operate the two channels of a pair at rates that are multiples of the same basic rate (56 or 64 kbps), or at multiples of different basic rates. However, in the latter case configure the second (even-numbered) channel of a pair to operate at a multiple of 64 kbps, and configure the first (odd-numbered) channel to operate at a multiple of 56 kbps.

In addition to the normal full-duplex (bidirectional) mode, HS-6N, HS-12N support additional transmission modes, which enable point-to-multipoint communication:

- Unidirectional (simplex) transmission, where each channel can be configured either to receive (unidirectional RX) or transmit (unidirectional TX).
- Bidirectional broadcast (half-duplex) communication, suitable for polled applications. In this mode, a channel can either transmit or receive, but not both simultaneously (the direction of transmission is determined by the state of the local RTS line). This mode is supported only by the MP-2100 chassis.
- Bidirectional broadcast ring mode that supports the Megaplex E1/T1 ring topologies, and therefore combines the rapid response of master/slave polling with the resiliency of the ring topology. To increase bandwidth utilization efficiency in this mode, the HS-6N, HS-12N modules can also perform submultiplexing, by allowing several low-rate (64 kbps) channels to access the same main link timeslot. This mode is supported only by the MP-2100 chassis.

For a description of these modes, see the *Megaplex-2100/2104 Installation and Operation Manual*.

The timing mode of each channel can be configured to either DCE, external DCE or DTE timing modes. The external DCE mode is used for tail-end applications, whereas the DTE mode enables using an external clock source in applications that require connecting to a data line provided by a data carrier service (for example, DDS or Kilostream), with the external clock available as a system nodal timing source.

The operating mode of each channel is independently selectable, using the Megaplex management system or a supervision terminal.

The module has extensive diagnostics capabilities that reduce downtime to a minimum. These capabilities include a comprehensive self-test initiated upon power-on, local and remote loopbacks. The MP-2100/2104 chassis also supports BER testing using an on-board test subsystem.

The module channels are terminated on 68-pin SCSI-4 female connectors. Each connector contains three channels, and therefore HS-6N has two connectors, and HS-12N has four connectors. Adapter cables, available upon order, are offered by RAD to split each module connector into three separate channel interfaces with standard connectors.

Typical Applications

Basic Applications

Figure 1-1 illustrates a HS-12N application that provides a large number of users with flexible access to an SDH/SONET network. The total number of data channels available in one fully equipped Megaplex-2100 unit is 120, where each channel can operate at any data rate within the range supported by HS-12N.

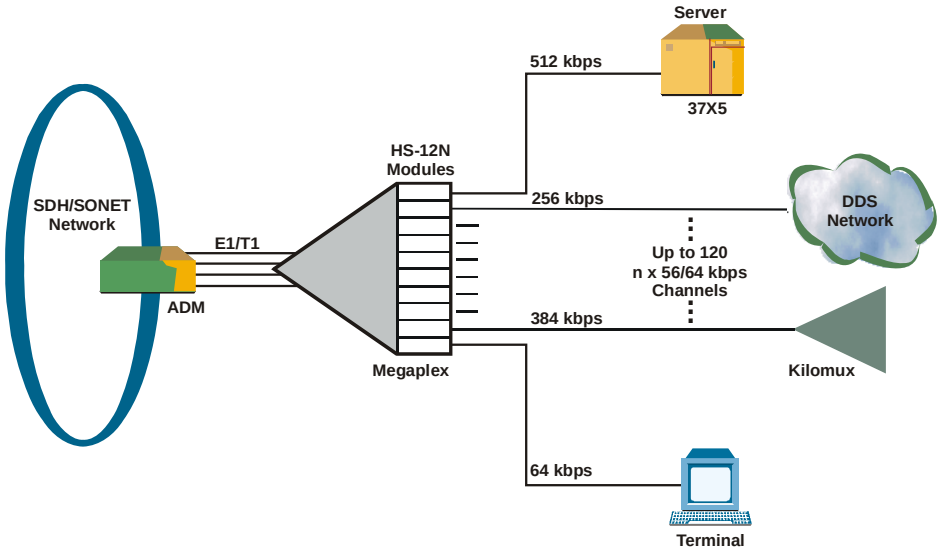


Figure 1-1. Typical HS-12N Application – Connecting 120 Data Channels to SDH/SONET Network

Figure 1-2 shows another application that enables users at several remote sites, e.g., branch offices, to connect to data equipment or other users at a central site (company headquarters) through a single HS-12N module.

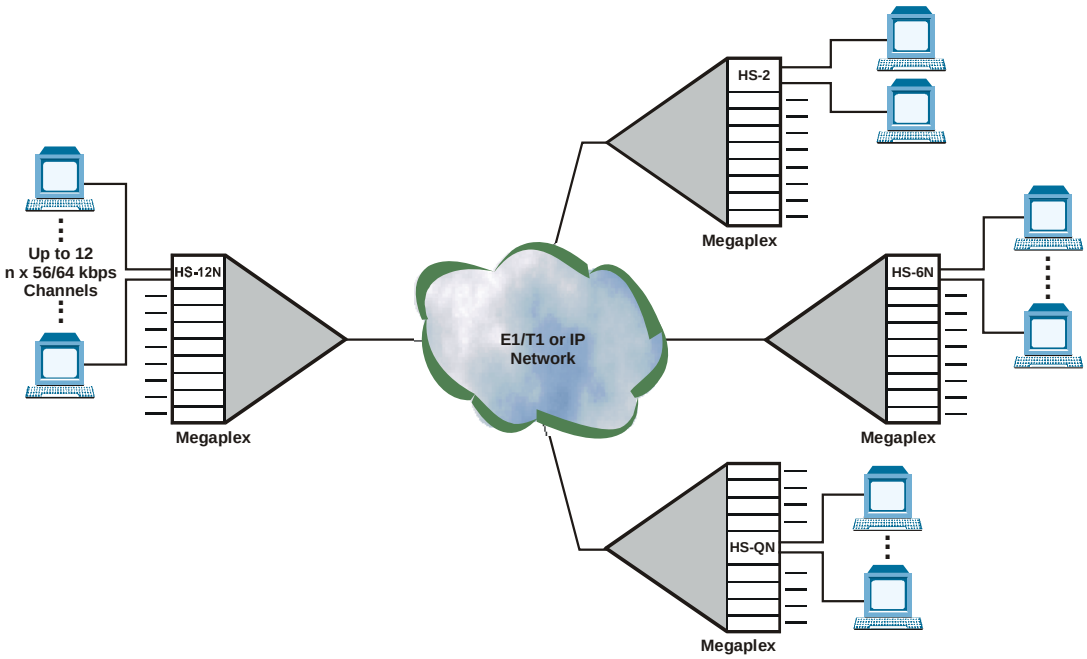


Figure 1-2. HS-12N at Central Site Serving Multiple Remote Sites

Point-to-Multipoint Applications

Unidirectional Broadcast Mode Applications

The unidirectional broadcast mode enables a user at a central location to send data to multiple users connected to remote Megaplex units (simplex communication), while using only the number of timeslots needed to support the desired data rate.

In this mode, any message is simultaneously received by all the unidirectional users, but none of them can send back data to the originator. This capability is achieved by separating the handling of the receive and transmit paths for the timeslots assigned for the unidirectional channels, as shown by the dashed lines within the Megaplex units in *Figure 1-3.*

Figure 1-3 shows a network that uses the unidirectional broadcast mode to distribute data from a central location (A) to several remote locations (B, C, D, etc.). In *Figure 1-3*, the user at the central location (A) is connected to an HS-12N channel configured for operation in the unidirectional transmit mode. The channels of the remote users (at locations B, C, D) are configured for the unidirectional receive mode.

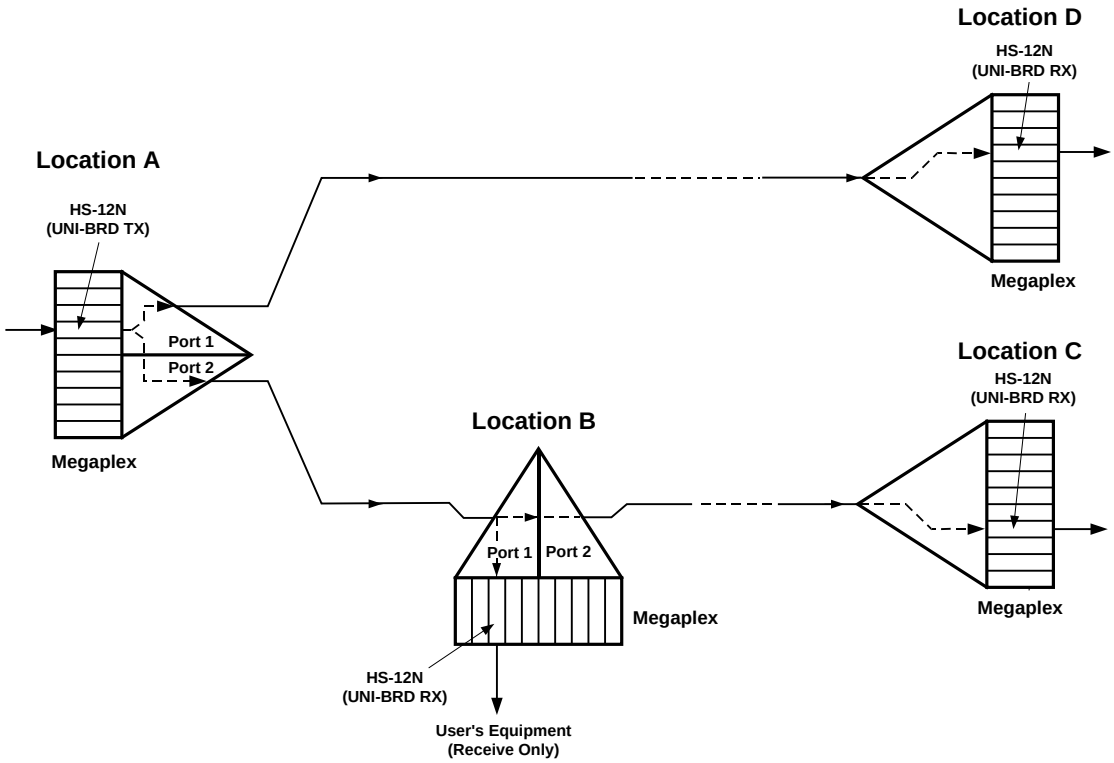


Figure 1-3. Typical Unidirectional Broadcast Application

At location A, the timeslots assigned to the user is routed to two main link ports of the Megaplex unit, and can be inserted in timeslots with different numbers.

For simplicity, first the path to the user at location D is described:

- In the forward path (from location A to D), the timeslots assigned to the HS-12N channel configured for unidirectional transmit operation are routed through the desired timeslots of port 1 to the Megaplex unit at location D.

At location D, the timeslots are routed to the receive path of the unidirectional receive HS-12N channel. Therefore, the user D receives data sent by user A.

- In the reverse path (from location D to A), the timeslot is always disconnected. Therefore, the user D cannot transmit data to user A.

The path to the users B and C is as follows:

- In the forward path (from location A to B, C, etc.), the timeslots assigned to the HS-12N channel configured for unidirectional transmit operation are routed through the desired timeslot of port 2 to the Megaplex at location B.

  At location B, the timeslots received at port 1 are routed as follows:

  - To the receive path of user B, configured for unidirectional receive mode
  - To the desired timeslots of port 2 (bypassing), which are connected to the Megaplex at location C.

  Therefore, the transmit signal of user A is relayed to the following units, and the users at locations B and C receive data sent by user A.

Note

The timeslots can be connected in parallel to any number of channels.

- In the reverse path (to location A), the timeslots are always bypassed from port 2 to port 1, en route to location A.

  To prevent interference from the unidirectional channel, its transmit path is always disconnected from the main link timeslots (at location B, no information is inserted in the timeslot bypassed from port 2 to port 1), and user B cannot transmit data to any other user. The same is true for the user at location C.

Figure 1-4 shows another network configuration, which enables regular (full duplex, or bidirectional) communication between two users (the users at locations A and C), and in addition enables monitoring the data sent by the user A at location B.

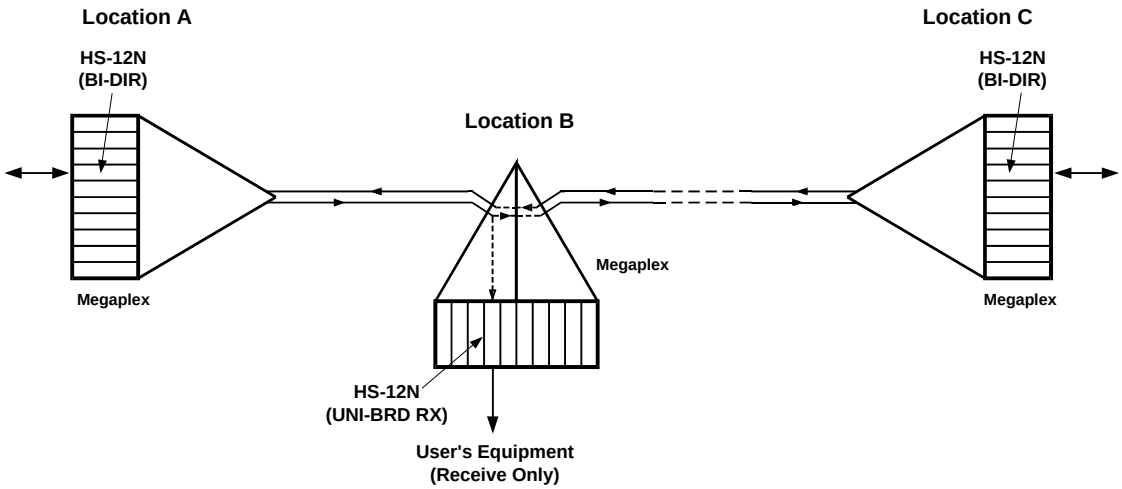


Figure 1-4. Typical Unidirectional Receive Application

For this configuration, the users A and C are configured as regular users, and only the user at location B is configured for unidirectional receive operation.

Bidirectional Broadcast Mode Applications

The bidirectional broadcast mode, used for chain topologies, enables a user at a central location to communicate half-duplex with several users connected to remote Megaplex units, as needed, for example, to use polling. *Figure 1-5* shows a network topology using the bidirectional broadcast capability.

Note *The bidirectional broadcast mode is not available for the module operating in the Megaplex-4100 chassis.*

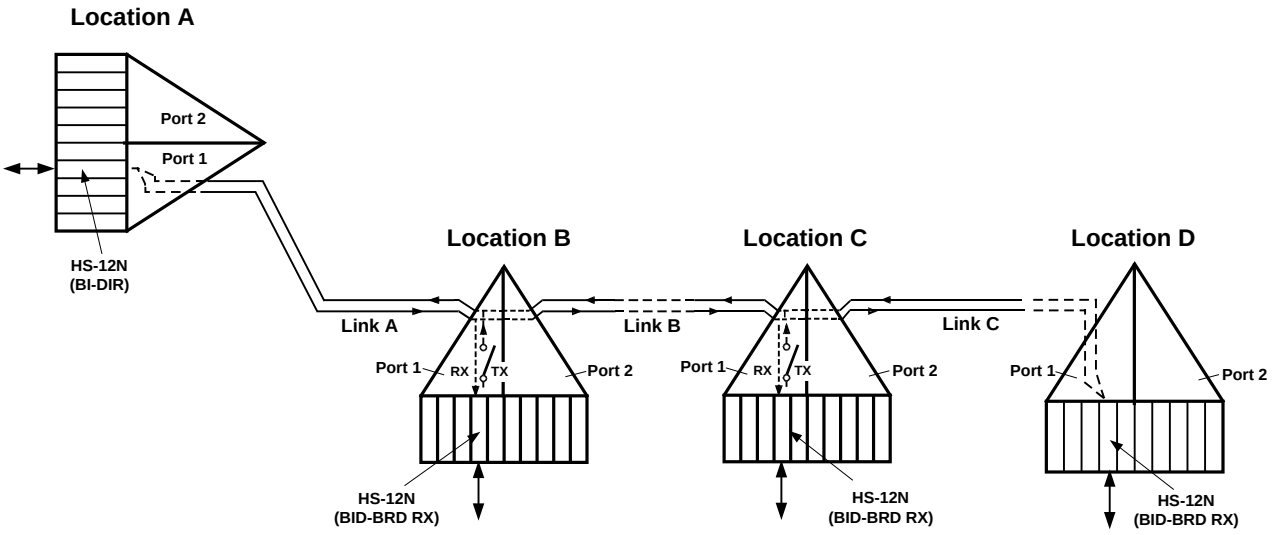


Figure 1-5. Typical Bidirectional Broadcast Application

The broadcast capability is achieved by separating the handling of the receive and transmit paths for the timeslots assigned for the broadcast channels, as shown by the dashed lines within the Megaplex units in *Figure 1-5.*

The user at the central location (the master in a polling application) is configured to use the regular (bidirectional) mode. The other users (the slaves in a polling application) are configured to use the bidirectional broadcast receive (BID BRD RX) mode: this mode is similar to the unidirectional receive mode, except that at any time only one of these users can transmit to (and be received by) user A, as needed in polling applications.

In the application shown in *Figure 1-5*, the handling of the signals generated by user A is similar to that for the unidirectional transmit mode described above. The difference is that each broadcast user can insert its signal in the receive timeslots that reach user A (instead of the signal bypassed from the other link). The change in routing is controlled by the RTS signal in the data connector of the HS-12N module:

- When the RTS signal is not active (idle state), the receive timeslots are bypassed from port 2 to port 1, and continue toward user A.
- When the RTS signal is asserted, the receive timeslot of port 2 is disconnected from port 1, and the transmit path of the local broadcast user is connected to port 1.

Thus, user A can request any user to answer, and that user can assert its RTS line and thus connect to user A. At any time, only one user may transmit toward user A (if more than one user transmits, only the user closest to location A will actually be received).

When using the bidirectional broadcast receive mode, it is necessary to instruct each main link port how to handle the traffic flow and signaling information. This is performed by defining the timeslot type, as part of the DEF TS command (see *Megaplex-2100/2104 Installation and Operation Manual*).

Bidirectional Broadcast Ring Mode Applications

The bidirectional broadcast mode, used for E1 and T1 ring topologies, provides capabilities similar to those described above while taking advantage of the resiliency of the E1 and T1 ring topology (see general description of the E1/T1 ring topology in the *Megaplex-21004 Installation and Operation Manual*). In addition, this mode improves the response time of the master/slave polling.

Note *The bidirectional broadcast mode is not available for the module operating in the Megaplex-4100 chassis.*

Figure 1-6 shows a network topology that uses the bidirectional broadcast ring capability.

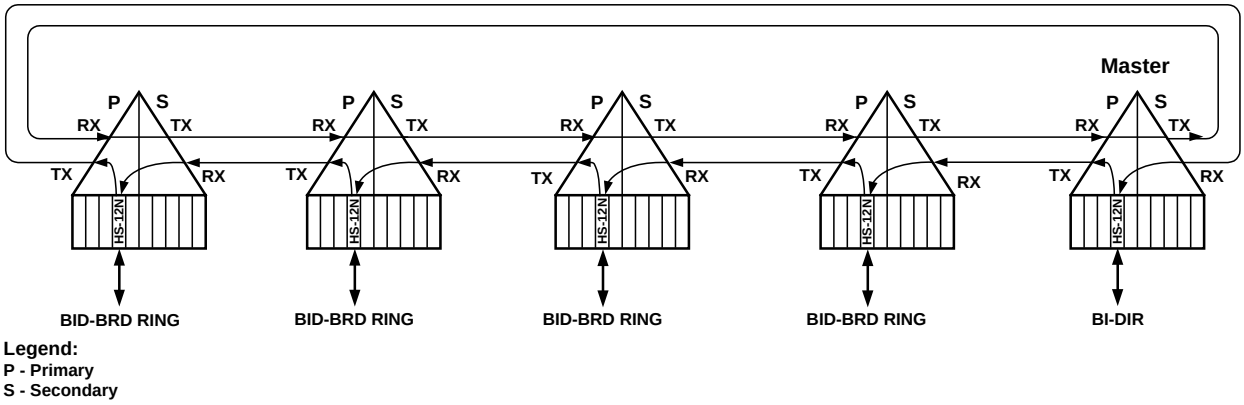


Figure 1-6. Typical Bidirectional Broadcast Ring Application

In the application shown in *Figure 1-6*, the HS-12N channel serving the master user (located in the rightmost Megaplex unit) is configured to use the regular (bidirectional) mode. The other users (the slaves in a polling application) are configured to use the bidirectional broadcast ring (BID BRD RING) mode.

Note *Figure 1-6 through Figure 1-9 present only the route followed by the timeslots carrying the payload of the HS-12N channel configured to bidirectional broadcast ring mode.*

Figure 1-7 shows the signal routing details within the Megaplex units with channels configured to use the bidirectional broadcast ring:

- Channel idle (RTS OFF):
  - The primary ring timeslots serving the channel are routed to the HS-12N module for processing: the transmit timeslots are bypassed by means of the internal routing matrix of the module (see *Section 1.3*), whereas the

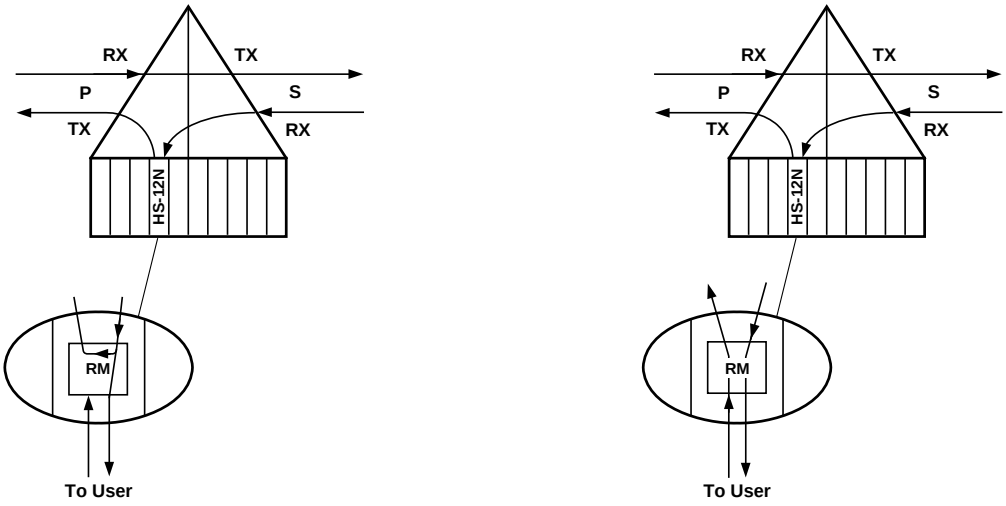
receive timeslots are processed, and their payload is sent to the user's equipment through the corresponding channel interface.

- All the secondary ring timeslots are bypassed within the main link module, as explained in the *Megaplex-2100 Installation and Operation Manual*.

- Channel active (RTS ON): in this case, the routing within the HS-12N module changes: the HS-12N routing matrix now inserts the payload received from the user's equipment into the channel transmit timeslots. All the secondary ring timeslots are bypassed within the main link module.

The routing described above makes the primary ring completely transparent to all the timeslots assigned to other payload. The only difference is in the routing of the timeslots assigned to the local channel configured to use the bidirectional broadcast ring:

- When the channel is idle, these timeslots are transparently transferred
- When the channel is active, its payload is inserted within these timeslots.



Routing when Channel is Idle (RTS is OFF) *Routing when Channel is Active (RTS is ON)*

Figure 1-7. Signal Routing in the Bidirectional Broadcast Ring Mode

Figure 1-8 shows the signal flow when a fault occurs on the primary ring, and *Figure 1-9* shows the routing details within the Megaplex units.

Comparing *Figure 1-9* to *Figure 1-7* shows that under fault conditions, the internal routing matrix directs the payload to the operational ring, while ignoring data received from the faulty ring. Ring functionality is thus retained, both with respect to the HS-12N channel and the timeslots assigned to other users.

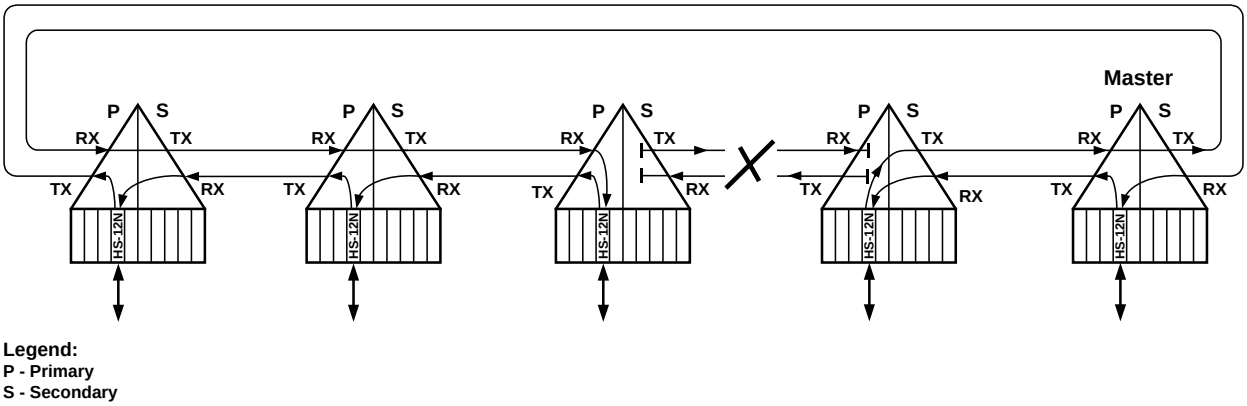
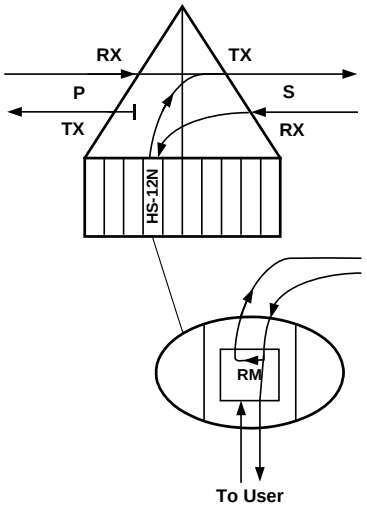
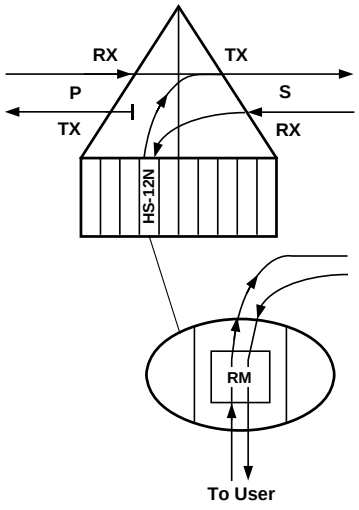


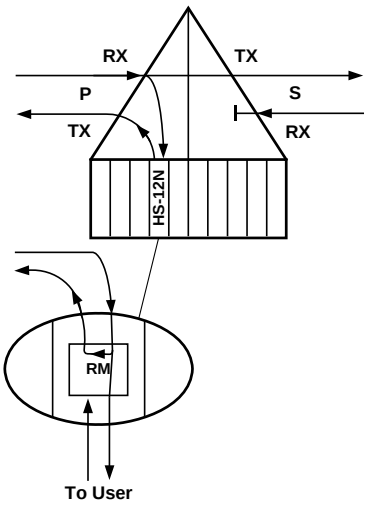
Figure 1-8. Signal Flow in Bidirectional Broadcast Ring Application during Primary Ring Fault



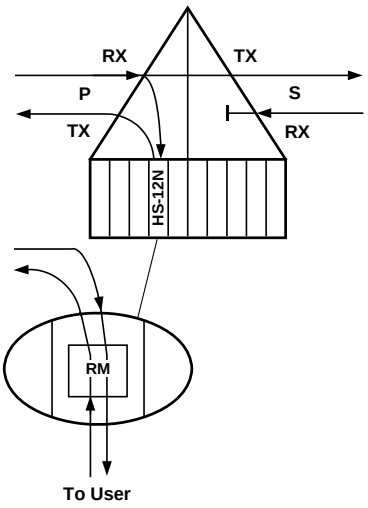
Primary Ring Fault – Channel Idle (RTS OFF)



Primary Ring Fault – Channel Active (RTS ON)



Secondary Ring Fault – Channel Idle (RTS OFF)



Secondary Ring Fault – Channel Active (RTS ON)

Figure 1-9. Signal Routing in the Bidirectional Broadcast Ring Mode during Ring Faults

Submultiplexing in Bidirectional Broadcast Ring Applications

The HS-6N, HS-12N offers a special submultiplexing mode, which reduces the number of timeslots needed on the main links, by enabling several channels to share the same main link timeslots.

Access conflicts are prevented as long as the polling regime enforced by the user's application is strictly observed: the application must ensure orderly access to the communication links, one channel at a time, while allowing sufficient time for the remote users to respond to polling on any given channel.

When these conditions are met, the user can configure any group of channels to share one or more main link timeslots. For this purpose, it is necessary to connect only one channel in the group to the desired timeslot; the other channels must be associated with the connected channel (by specifying its port number on the module).

The routing needed to connect any channel in the group to the timeslot assigned to the group, is performed by the internal cross-connect matrix of the module (see *Section 1.3*). The active channel is selected in accordance with the state of its RTS signal. Note however that at any time only one channel in each group can assert its RTS signal: if an additional channel asserts its RTS while another channel is already connected to the timeslot, the last channel that asserts the RTS line will be active.

The number of channels in a group is not restricted (up to the maximum number of channels on the module); moreover, several groups may also be formed, by associating the desired channels.

1.2 Physical Description

HS-6N and HS-12N are 4U-high modules that occupy one I/O slot in the Megaplex chassis. All the functional parameters of the modules are determined by software.

The panels of the HS-6N and HS-12N modules include only the channel interface connectors. *Figure 1-10* shows typical module panels. The module version and interface type also appear on the module panel.

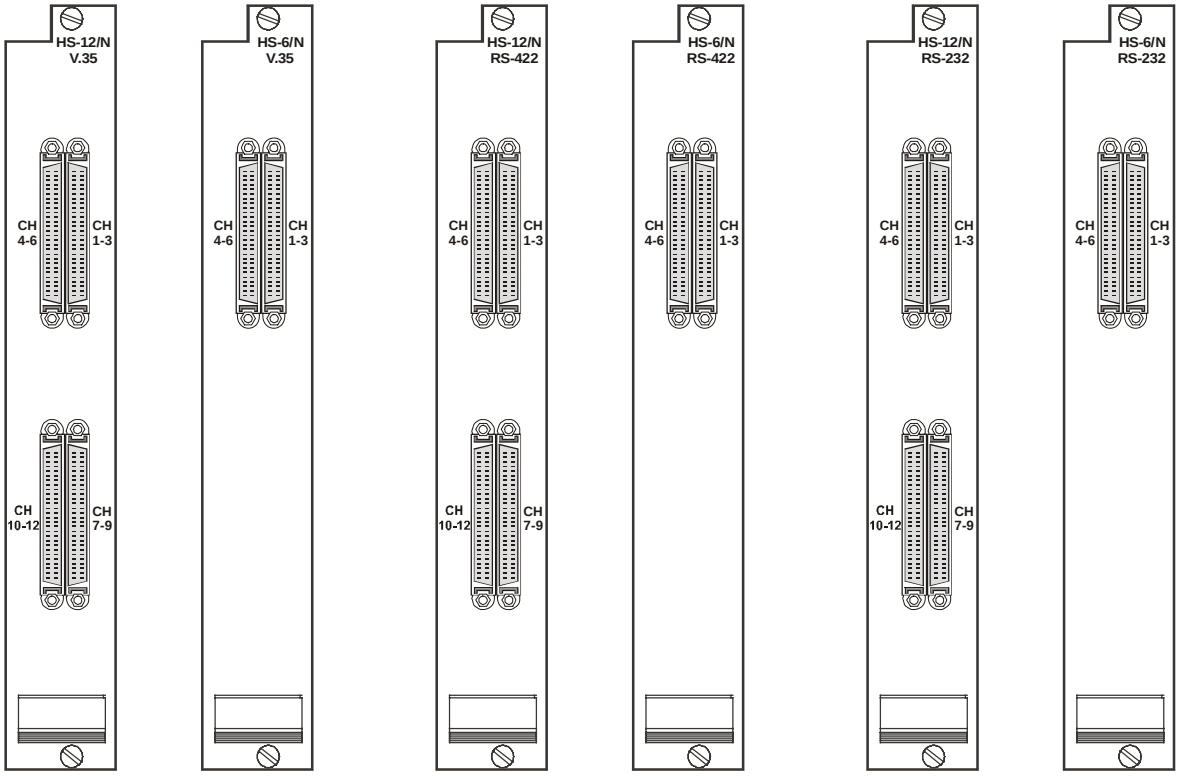


Figure 1-10. HS-6N/HS-12N Module Panels

1.3 Functional Description

HS-12N Functional Block Diagram

The functional block diagram of the HS-12N module is shown in *Figure 1-11*. The HS-6N is similar, except that it has only 6 channel interfaces.

The HS-12N module includes the following main subsystems:

- TDM bus interfaces
- Routing (cross-connect) matrix
- Channel interfaces
- Timing subsystem
- Test subsystem
- Local management subsystem.

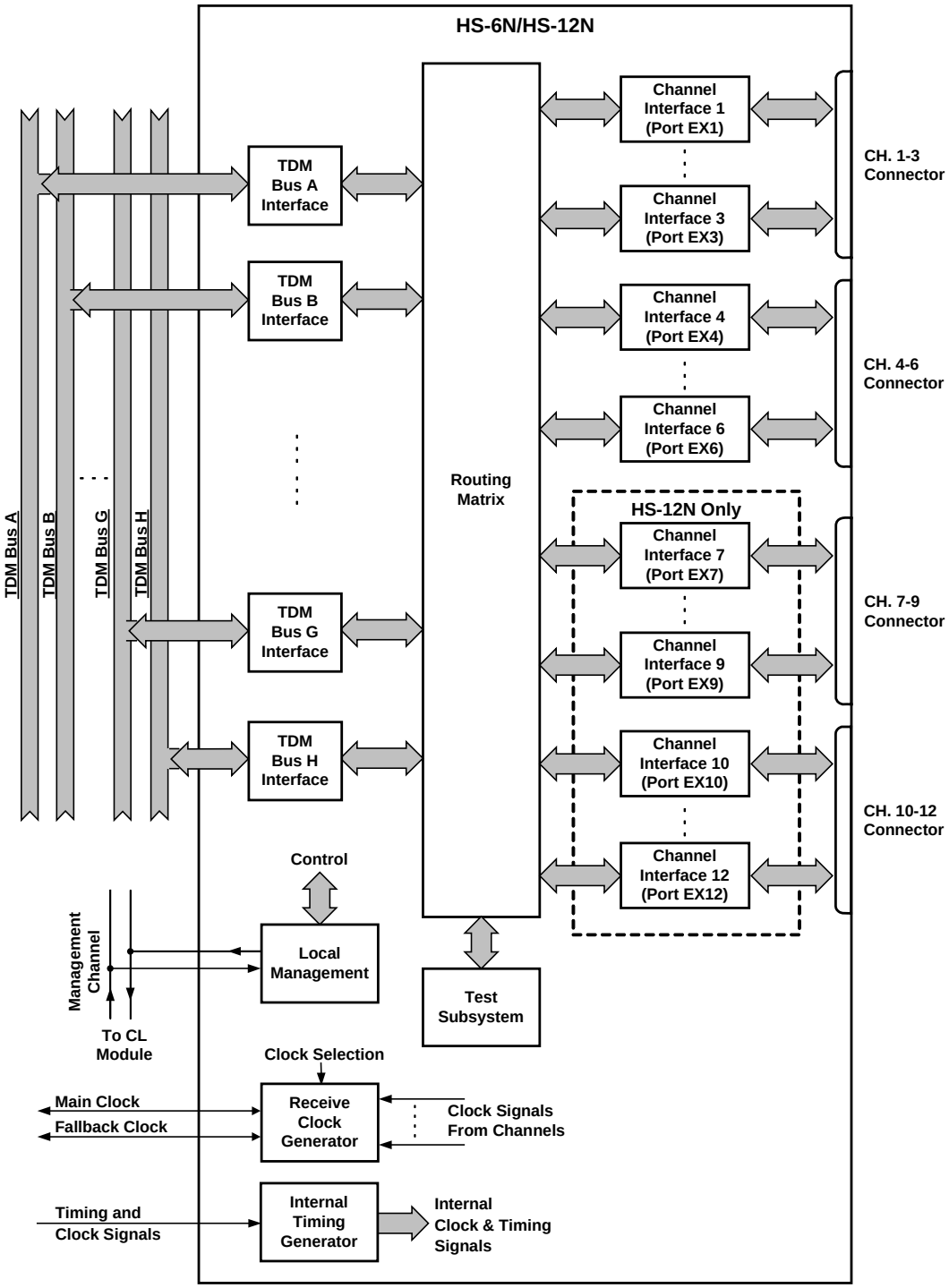


Figure 1-11. Module HS-12N, Functional Block Diagram

TDM Bus Interfaces

The HS-6N, HS-12N module has eight independent TDM bus interfaces, one for each Megaplex TDM bus. Each TDM bus interface is used to connect timeslots from the corresponding bus to the internal routing matrix of the HS-6N, HS-12N module, in accordance with the commands received from the CL module.

Routing Matrix

The HS-6N, HS-12N module includes a routing matrix that controls the routing of the module channels to the desired Megaplex uplink ports, via the TDM buses.

The Megaplex system enables you to select the uplink port that will carry the data applied to the HS-6N, HS-12N module channels. Moreover, you can select, for each module channel, the uplink timeslots assigned to that channel in the corresponding E1 or T1 uplink frame. User-controlled manual assignment allows the routing of the bit stream generated by each local channel to any other compatible Megaplex channel at the remote site, e.g., to another channel of a high-speed module such as HS-703, HS-2, HS-12N, etc.

Matrix routing is controlled by the CL module, and enables connecting any TDM bus timeslot to any channel. The routing matrix also supports:

- Unidirectional routing of timeslots
- Broadcasting from one timeslot to multiple destinations
- Submultiplexing in the bidirectional broadcast ring mode.

Refer to the *Applications* section starting on page *1-4* for details.

Channel Interfaces

Interface Characteristics

The HS-12N module can be ordered with the following interface types:

- V.35
- RS-422/V.11, which can be converted by means of adapter cables to V.36/RS-449, RS-530, or X.21 interfaces
- RS-232.

Interface Control Signals

Each channel has local support for the CTS, RTS, DCD, and DSR lines:

- The DSR line is always ON.
- The CTS line can be configured to be always ON, or to track the RTS line. The same selection must be made for all the channels.
- The DCD line is constantly ON, except when communications are not possible because of loss of frame synchronization.

Channel Timing Modes

Each HS-6N, HS-12N module channel supports three timing modes:

- DCE timing: the HS-6N, HS-12N channel provides the clock signals to the DTE connected to it. This mode is suitable for connecting equipment with DTE interface to the HS-12N channel.
- External DCE timing: the HS-6N, HS-12N channel provides the receive clock signal to the user's DTE, and accepts an external transmit clock. In this mode, the user's equipment must use loopback timing, that is, its transmit timing must be locked to the receive timing. This mode is suitable for tail-end applications.
- DTE timing: the HS-6N, HS-12N channel accepts the external transmit and receive clock signals from the user's equipment. In this case, the HS-6N, HS-12N channel can serve as the nodal timing source for the Megaplex system. This mode is suitable for connections to a digital transmission network, which has its own accurate timing source.

FIFO buffers are used in the receive and transmit path of each module channel, to absorb timing variations. FIFO size can be individually configured for each channel. The Megaplex system can automatically select the FIFO size in accordance with the minimum necessary. When a longer buffer is desired, the user can also manually select the FIFO size. The supported FIFO sizes are ±16 bits, ±30 bits, ±52 bits, and ±72 bits.

Timing Subsystem

The HS-6N, HS-12N module has an internal timing generator that receives the nodal timing and clock signals from the Megaplex chassis and generates the internal timing and clock signals needed for module operation.

The timing subsystem also generates clock signals locked to the timing of channels operating in the DTE mode, which can be selected as sources for the Megaplex nodal timing. Note that a channel can be serve as a timing source only when its RTS line is active, and therefore channels used in the polling mode are not suitable as nodal clock sources.

Diagnostics

The HS-6N, HS-12N modules include self-test upon power-up, and provides additional testing and diagnostic functions that can be controlled by system management. These capabilities enable to reduce downtime to a minimum. The testing capabilities include:

- Local loopback: the signal received by a module channel is looped back toward the local equipment.
- Remote loopback on the local channel: loopback toward the remote equipment.
- Bit error rate (BER) testing (MP-2100 only).

BER Test Subsystem

The BER test subsystem is used to check the transmission performance and proper operation of the paths carrying the user's payload on the link toward the remote user without requiring any external test equipment.

The BER test subsystem comprises a test sequence generator that generates an RJ-011 sequence, and a test sequence evaluator. The output and input of the BER test subsystem are routed by the routing matrix.

During the test, the payload data is replaced by the sequence generated by the test sequence generator. The transmitted data is returned to the test sequence evaluator by a loopback activated somewhere along the signal path. The evaluator synchronizes to the incoming sequence, and then compares the received data, bit by bit, to the original data sequence and detects any difference (bit error).

The test results are displayed as a number in the range of 0 (no errors detected during the current measurement interval) through 65535. If the upper limit is reached, the counter stops accumulating errors and retains this maximum value until it is manually reset.

Error counts are accumulated starting from the first synchronization to the BER test pattern, or from the last clearing (resetting) of the error counters. During normal operation, no errors should be detected.

At any time, only one BER test can be performed on the HS-6N, HS-12N module.

Local Management Subsystem

The local management subsystem controls the operation of the various circuits located on the HS-6N, HS-12N module and the activation of the various diagnostic functions, in accordance with the commands received from the CL module through the Megaplex management channel.

1.4 Technical Specifications

Number of Channels	*HS-6N*	Six synchronous data channels
	HS-12N	Twelve synchronous data channels
Channel Characteristics	*Electrical Interface*	• V.35 • V.11/RS-422 • V.24/RS-232
	Physical Interface	• V.35 (via adapter cable) • V.36/RS-449, RS-530, or X.21 (via adapter cables) • RS-232 (via adapter cable)
	Channel Data Rates	n×56 or n×64 kbps rates, independently selectable per channel: • E1: n = 1 to 31 • T1: n = 1 to 24 ***Note***: For HS-6N/12N modules with RS-232 interfaces, the only supported rate is 64 kbps.
	Connectors	68-pin SCSI female connector per each 3 data channels (2 connectors for HS-6N and 4 connectors for HS-12N)
Timing Modes	*DCE*	HS-6N, HS-12N channel provides both RX and TX clocks to the user's DTE
	External-DCE	HS-6N, HS-12N channel provides RX clock to user while receiving TX clock from user. Used for tail-end applications
	DTE	HS-6N, HS-12N channel receives both RX and TX clocks from the user's DCE
Control Signals		• CTS follows RTS or is constantly ON, soft-selectable (same setting for all channels) • DCD constantly ON, except during sync loss • DSR always ON
Power Consumption	*HS-6N*	Max. 5.5W
	HS-12N	Max. 6.25W
Configuration	Programmable via Megaplex system management	

Chapter 2

Installation and Operation

2.1 Introduction

This chapter provides installation and operation instructions for the HS-6N, HS-12N modules.

The information presented in this chapter supplements the general Megaplex installation, configuration and operation instructions contained in the *Megaplex-2100/2104 Installation and Operation Manual* and *Megaplex-4100 Installation and Operation Manual*.

Warning

Before performing any internal settings, adjustment, maintenance, or repairs, first disconnect all the cables from the module, and then remove the module from the Megaplex enclosure.
No internal settings, adjustment, maintenance, and repairs may be performed by either the operator or the user; such activities may be performed only by a skilled technician who is aware of the hazards involved.
Always observe standard safety precautions during installation, operation, and maintenance of this product.

Caution

The HS-6N, HS-12N modules contain components sensitive to electrostatic discharge (ESD). To prevent ESD damage, always hold the module by its sides, and do not touch the module components or connectors.

2.2 Installing the Module in the Chassis

The HS-6N/12N module can be installed in an operating chassis (hot insertion).

For general installation procedures and safety instructions, refer to the *Megaplex-2100/2104* or *Megaplex-4100 Installation and Operation Manual.*

Insert the module in the prescribed I/O slot and fasten it with its two screws.

The module starts operating as soon as it is plugged into an operating Megaplex enclosure.

2.3 Connecting the Cables

The user's equipment is connected to HS-12N modules via 68-pin SCSI female connectors designated CH. 1-3, CH. 4-6, CH. 7-9, CH. 10-12. For HS-6N modules, only the CH. 1-3 and CH. 4-6 connectors are used.

RAD offers adapter cables for directly connecting user's equipment with standard connectors to the appropriate 68-pin SCSI connector located on the HS-6N/12N module. *Figure 2-1 s*hows a typical adapter cable, and *Table 2-1* provides information on the adapter cables available from RAD.

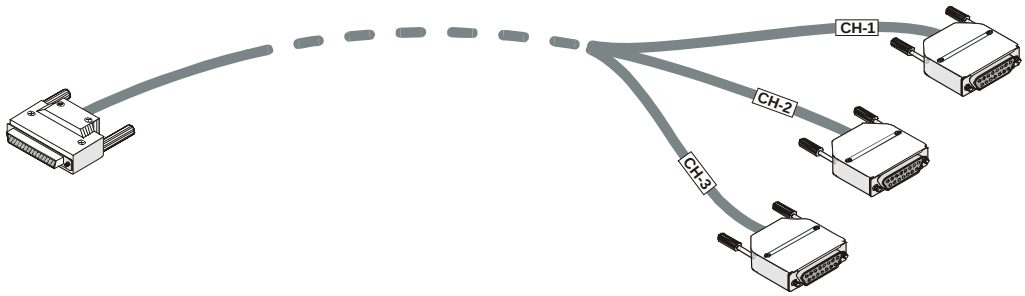


Figure 2-1. CBL-SCS68/3/X21/M Cable

Table 2-1. Adapter Cables Offered by RAD

Module Version	Adapter Cable	User's Side Connectors
V.35	CBL-SCS68/3/V35/M	34-pin VAPL male connector
RS-422	CBL-SCS68/3/530/M	25-pin D-type male connector
	CBL-SCS68/3/X21/M	15-pin D-type male connector
	CBL-SCS68/3/V36/M	37-pin D-type male connector
	CBL-SCS68/3/V36/F	37-pin D-type female connector
RS-232	CBL-SCS68/3/232/M	25-pin D-type male connector

➤ **To connect the cables:**

1. Identify the cables intended for connection to each module connector and connect them into the appropriate connectors.
2. When using any of the adapter cables, plug each channel connector at the other end of the cable into the prescribed user's equipment connector in accordance with the site installation plan.

The pin assignment of the CH connectors and of the adapter cables is given in *Appendix A*.

Chapter 3
Configuration

3.1 Introduction

This chapter provides configuration information for HS-6N/12N modules installed in the Megaplex-2100/2104 or Megaplex-4100 chassis. For general instructions and additional configuration procedures, refer to *Megaplex-2100/2104 Installation and Operation Manual* and *Megaplex-4100 Installation and Operation Manual,* respectively.

The configuration is performed by means of the management system used to control the Megaplex unit:

- Supervision terminal or Telnet – refer to the *Megaplex-2100/2104 or Megaplex-4100 Installation and Operation Manual* for instructions.
- Web browser – refer to the *Megaplex-4100 Installation and Operation Manual* for instructions.
- Network management system, e.g., the RADview network management system – refer to the *RADview User's Manual* for instructions.

3.2 Configuration Sequence for the MP-2100/2104 Chassis

➤ **To configure an HS-6N, HS-12N module and put it into service:**

1. Add an HS-6N, HS-12N module not yet installed in the Megaplex-2100/2104 chassis to the database. This allows preconfiguring the module parameters, so that the module will immediately start operating in the desired mode as soon as it is installed in the enclosure. For the supervision terminal, use the DEF SYS command.
2. Configure the HS-6N, HS-12N channel parameters:
   - To define the parameters of all the module channels on the supervision terminal, type the command:

     DEF CH SS *
   - To define the parameters of a desired channel on the supervision terminal, type the command:

     DEF CH SS CC

where SS is the slot number, and CC is the channel number (1 to 6 for HS-6N and 1 to 12 for HS-12N). For the parameter description, see *Table 3-1*.

3. When necessary, modify the system timing reference to use the receive clock of a HS-6N, HS-12N port as timing reference. For the supervision terminal, use the **DEF SYS** command (for instructions, refer to the *Megaplex-2100/2104 Installation and Operation Manual*).
4. Assign timeslots as described in *Section 3.5*.

Note

Make sure to plan ahead the configuration sequence, because Megaplex databases can be updated only after correctly completing the configuration activities: any sanity error will prevent saving the changes to the database being modified.

3.3 Configuration Sequence for the MP-4100 Chassis

➤ **To configure an HS-6N, HS-12N module and put it into service:**

1. Add an HS-6N, HS-12N module not yet installed in the Megaplex-4100 chassis to the database. This allows preconfiguring the module parameters, so that the module will immediately start operating in the desired mode as soon as it is installed in the enclosure.

   For the supervision terminal, use the **Configuration>System>Card Type** screen.
2. Configure the CLX or M8E1/M8T1 module port parameters (depending on the HS-6N/12N module application). For the configuration procedure, refer to the appropriate Installation and Operation Manual.
3. Configure the HS-6N, HS-12N port parameters. For the supervision terminal, use the **Configuration>Physical Ports>I/O** screen.
4. When necessary, modify the system timing reference to use the receive clock of a HS-6N, HS-12N port as timing reference. For the supervision terminal, use the **Configuration>System>Clock Source** screen (for instructions, refer to the *Megaplex-4100 Installation and Operation Manual*).
5. Configure the timeslot assignment of each module port, using the **Configuration>System>TS Assignment** screen.

Note

Make sure to plan ahead the configuration sequence, because Megaplex-4100 databases can be updated only after correctly completing the configuration activities: any sanity error will prevent saving the changes to the database being modified.

3.4 Configuration Parameters

Each HS-6N, HS-12N channel (external port) can be independently configured in accordance with the system requirements.

Table 3-1 explains the programmable parameters of the HS-12N channels, and their ranges of values.

Table 3-1. Channel Parameters

Parameter	Function	Values
Connect (MP-2100 only)	Determines whether the channel is connected to the internal TDM buses of the Megaplex chassis	**NO** The channel is disconnected. You can still program the desired parameters, so the channel will be ready to operate when needed. **YES** The channel is connected to a legacy main link port, and can carry traffic. **Default: NO**
Admin Status (MP-4100 only)	Used to enable/disable the flow of traffic through the selected port	**UP** The flow of traffic is enabled. **DOWN** The flow of traffic is disabled. This state should be selected as long as the port configuration has not yet been completed, or when it is necessary to stop traffic flow through the port. **Default: DOWN**
Rate	Specifies the data rate of this channel. The data rate determines the number of timeslots allocated to the channel on the selected uplink. The data rate is shown both as a multiple of a basic rate (56 or 64 kbps), and as an absolute number in kbps. This representation has the advantage that you can see at a glance the required number of timeslots. When selecting the rate, take into consideration the number of timeslots used by, or must be reserved for, other channels using the same uplink. Moreover, if an E1 link is used and the framing method is G.732S, you must also reserve one timeslot (timeslot 16) for signaling. The total rate assigned to a pair of consecutive channels, for example, 1 and 2, 3 and 4, etc., cannot exceed 1984 kbps (31 timeslots). In addition, you cannot select a multiple of 64 kbps for the first (odd) channel of a pair, and a multiple of 56 kbps for the even channel	The allowed range is **n×56 kbps** or **n×64 kbps**, where **n** is 1 through 24 for a T1 link, and 1 through 31 for an E1 link. For HS-6N/12N modules with RS-232 interfaces, the only supported rate is 64 kbps. **Default: 1x64 = 64 KBPS**

Parameter	Function	Values
Clock Mode	Selects the clock mode used by the channel. For a description of channel timing modes, refer to the corresponding *Megaplex Installation and Operation Manual*.	**DCE** – The channel provides transmit and receive clocks to the user's equipment. **EXTERNAL DCE** – The channel provides the receive clock to the user's DTE, and accepts the transmit clock from the user's equipment. **DTE** – The channel accepts transmit and receive clocks from the user's equipment. **Default: DCE**
CTS	Selects the state of the channel CTS line. You must make the same selection for all the module channels	**ON** The CTS line is continuously on. **RTS** The CTS line tracks the state of the local RTS line. **Default: ON**
FIFO Size	Selects the size of the FIFO buffer used by the channel. In general, you should select **AUTOMATIC**. For special applications that require longer buffers, you may want to select manually one of the supported FIFO sizes (±16 bits, ±30 bits, ±52 bits, or ±72 bits)	**AUTOMATIC –** Automatic selection of FIFO size. The automatically selected value depends on the channel data rate: • ±16 bits for 64 kbps • ±30 bits for 128 and 192 kbps • ±52 bits for 256 through 320 kbps • ±72 bits for 384 through 1536 kbps • ±52 bits for 1600 through 1792 kbps • ±30 bits for 1856 and 1920 kbps • ±16 bits for 1984 kbps. **16 BITS, 30 BITS, 52 BITS, 72 BITS –** Selects a specific FIFO size: ±16 bits, ±30 bits, ±52 bits, or ±72 bits, respectively. Make sure to select a value equal to, or exceeding, the automatically selected value at the operating data rate. **Default: AUTOMATIC**
BRD SRC CH (MP-2100 only)	Controls the use of submultiplexing, a function supported in the **BID-BRD RING** mode. See configuration guidelines on page *3-7*	**NONE** Submultiplexing is disabled. This is the only allowed selection when the **Operation Mode** is not configured as **BID-BRD RING.** **EX1** to **EX6** or **EX12** Submultiplexing is enabled, and the configured channel is being associated with the channel selected in this field. **Default: NONE**

Parameter	Function	Values
Operation Mode	Selects the operation mode	**BI-DIR** – Bidirectional (regular) mode. **UNI-BRD TX** – Unidirectional broadcast transmit mode. **UNI-BRD RX** – Unidirectional broadcast receive mode. **BID-BRD RX** – Bidirectional broadcast receive mode (MP-2100/2104 only) **BID-BRD RING** – Bidirectional broadcast mode for E1/T1 ring topologies (MP-2100/2104 only) **Default: BI-DIR**
ML Slot (MP-2100 only)	Selects the I/O slot number of the destination main link module	• When using the **BI-DIR**, **UNI-BRD RX, BID-BRD RX,** or **BID-BRD RING** modes, you can select the desired I/O slot. • When using the **UNI-BRD TX** mode, this field automatically changes to **BRD**, to remind you that the destination port must be selected using the DEF TS command. **Default: IO-1**
ML Channel (MP-2100 only)	Selects the number of the main link port on the selected destination main link module	• When using the **BI-DIR**, **UNI-BRD RX, BID-BRD RX** or **BID-BRD RING** mode, you can select the desired external port number. The supported range depends on the number of external ports available on the main link module installed in the slot selected by the **ML Slot** parameter. • When using the **UNI-BRD TX** mode, this field automatically changes to **BRD**, to remind you that the destination port must be selected using the DEF TS command. **Default: EX1**
Destination Slot (MP-4100 only)	Specifies the module (I/O slot) to which the data stream handled by the port is routed.	The available selections are the CLX module installed in the chassis, and I/O modules IO-1 to IO-10. **Default: –**
Destination Port (MP-4100 only)	Specifies the port to which the data stream handled by the port is routed.	The available selections are 1 to 8 for external ports, or 1 to 63 (1 to 84) for internal (virtual) ports (actual range depends on the destination module). **Default: –**

Parameter	Function	Values
Map Type	Selects the timeslot mapping method when the destination is a TDM main link or CLX port. For a module installed in a MP-4100 chassis, this field appears only for the **UNI-BRD RX** mode.	• When using the **BI-DIR, UNI-BRD TX** or **BID-BRD RING** mode for a module installed in a MP-2100 chassis, this field automatically changes to **N/A**, to remind you that the destination must be selected using the DEF TS command • When using the **UNI-BRD RX** or **BID-BRD RX** mode, you can select the desired mode: **USER** — You can select the desired uplink timeslots on the timeslot map. **SEQUENCE** — The external port is assigned consecutive timeslots, starting with the timeslot specified by means of the **Start TS** parameter. **Default: N/A**
Start TS	Selects the starting timeslot in the frame of the destination TDM uplink port. This parameter can be selected only when using the **SEQUENCE** mapping mode; when using any other mode, this field automatically changes to **N/A**.	The allowed range is 1 to 31 for E1 ports, and 1 to 24 for T1 ports. **Default: N/A**

3.5 Assigning Timeslots

After performing the configuration of the individual module channels, it is necessary to assign the uplink bandwidth to each connected channel.

- When using the **BI-DIR, UNI-BRD TX** or **BID-BRD RING** mode in the module installed in the MP-2100/2104 chassis, use the **DEF TS** command as explained in the *Megaplex-2100/2104 Installation and Operation Manual*. For the module installed in the MP-4100 chassis, use the **Configuration>System>TS Assignment** screen.
- When using the **UNI-BRD RX** or **BID-BRD RX** mode in the module installed in the MP-4100 chassis, timeslot assignment for the receive direction is made using the dedicated routing fields of the **DEF CH** command. For the module installed in the MP-4100 chassis, use the **Configuration>Physical ports>IO** screen.

3.6 Configuring Timeslots for Submultiplexing (MP-2100/2104 only)

When using submultiplexing, only one channel in a group is connected to the main link, and therefore only that channel must be assigned a timeslot.

Example:

It is necessary to configure channels 1, 2, 3, 9 as a group using the timeslot assigned to channel 1, and channels 6, 7, 8, 12 as another group using the timeslot assigned to channel 7:

1. Make sure that all the channels (1, 2, 3, 6, 7, 8, 9, 12) are connected, configured for 64 kbps, and their **Operation Mode** is **BID-BRD RING**.
2. Assign one timeslot to channel 1 and another timeslot to channel 7.
3. For channels 1 and 7, configure the **BID-SRC CH** parameter to **NONE**.
4. For channels 2, 3, 9, configure the **BID-SRC CH** parameter to **EX1**.
5. For channels 6, 8, 12, configure the **BID-SRC CH** parameter to **EX7**.

3.7 Displaying Status and Configuration Information

The Megaplex-2100 user can read the HS-6N/12N status and configuration information using the **DSP ST CH** command. For a general description of this command, refer to *Appendix F* of the *Megaplex-2100/2104 Installation and Operation Manual*.

The **DSP ST CH** command includes two sections:

- **Hardware Config/Status**: displays the module interface type (V.35, RS-422, or RS-232), and the state of the RTS (or CI) line of each channel at the time the command has been received by the module.
- **Software Configuration**: displays a data form similar to that displayed by the **DEF CH** command, showing the current configuration of each channel. For a description of the displayed parameters, refer to *Table 3-1*.

The Megaplex-4100 user can read the configuration on every port of the I/O modules using the **Configuration>Physical Ports>I/O** menu. To display the HS-6N/12N hardware status and RTS state information, use the **Monitoring>Physical Ports>I/O** screen. For a general description of these menus, refer to *Chapter 4* of the *Megaplex-4100 Installation and Operation Manual*.

Chapter 4

Troubleshooting and Diagnostics

This chapter explains the specific diagnostic functions of the HS-6N and HS-12N modules and provides troubleshooting information.

For a description of the alarm and configuration ("sanity") error messages generated by HS-6N, HS-12N modules, refer to *Appendix B* of the *Megaplex-2100/2104 Installation and Operation Manual* or *Chapter 5* of the *Megaplex-4100 Installation and Operation Manual*.

The diagnostic information presented in this chapter supplements the general diagnostics and troubleshooting information instructions contained in the corresponding *Megaplex Installation and Operation Manual*.

4.1 Diagnostics

The HS-6N/12N modules have a complete set of tests and loopback that include:

- Local loopback on each channel
- Remote loopback on each channel
- Bit error rate test (BERT) on each channel.

When a test or loopback is activated, the user can also specify the time it remains active: the range is 1 through 30 minutes, in 1-minute steps. After the specified time, the test or loopback is automatically deactivated, thereby reducing the management workload during system troubleshooting. The default selection is continuous connection, that is, the test or loopback remain active until canceled by a user's command.

- To activate a test in a HS-6N, HS-12N module installed in a MP-2100 chassis, use the **DEF TST** (or **DEF TEST**) command, and then select the local/remote loopback or BERT, as described in the *Megaplex-2100/2104 Installation and Operation Manual*.
- To activate a test in a HS-6N, HS-12N module installed in a MP-4100 chassis, use the **Mp4100>Diagnostics>Physical Ports>I/O** menu, and then select the local or remote loopback, as described in the *Megaplex-4100 Installation and Operation Manual*.

The following sections describe the available diagnostic activities.

Local Loopback

The local loopback is performed at the channel input, by returning the transmit signal of the channel to the receive path. The transmit signal is still sent to the remote Megaplex unit.

A typical local loopback signal path for a HS-12N module is shown in *Figure 4-1*.

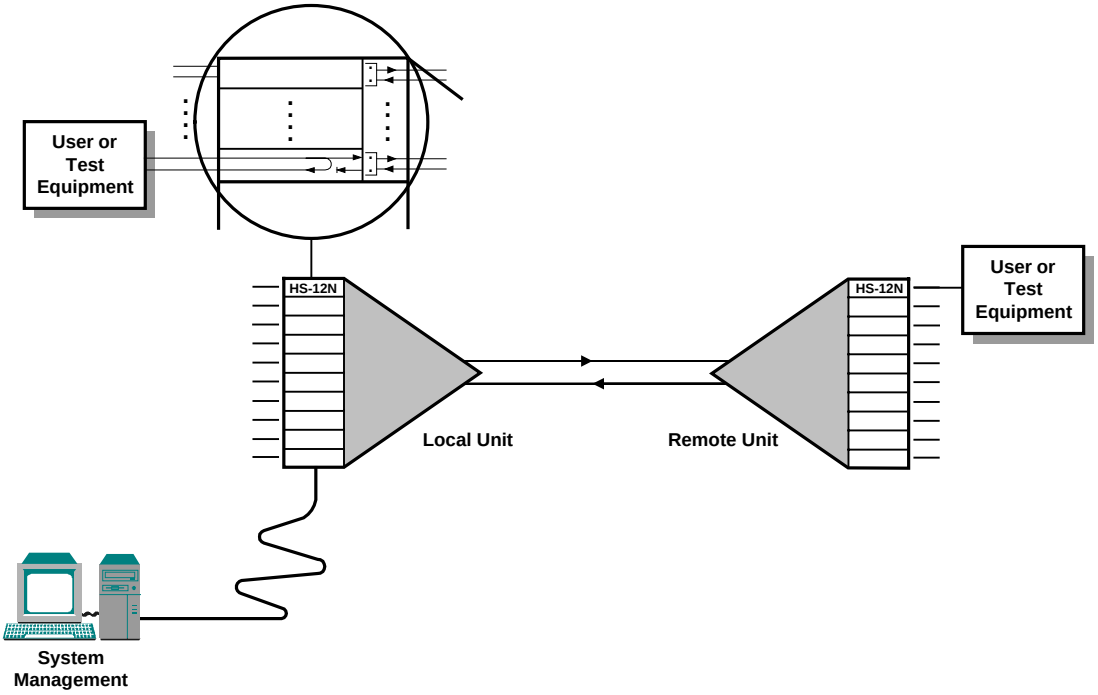


Figure 4-1. Local Loopback, Signal Path

Remote Loopback

The remote loopback is performed at the channel output, by returning the receive signal of the channel to the input of its transmit path. The receive signal is still available to the local user.

A typical remote loopback signal path for a HS-12N module is shown in *Figure 4-2*.

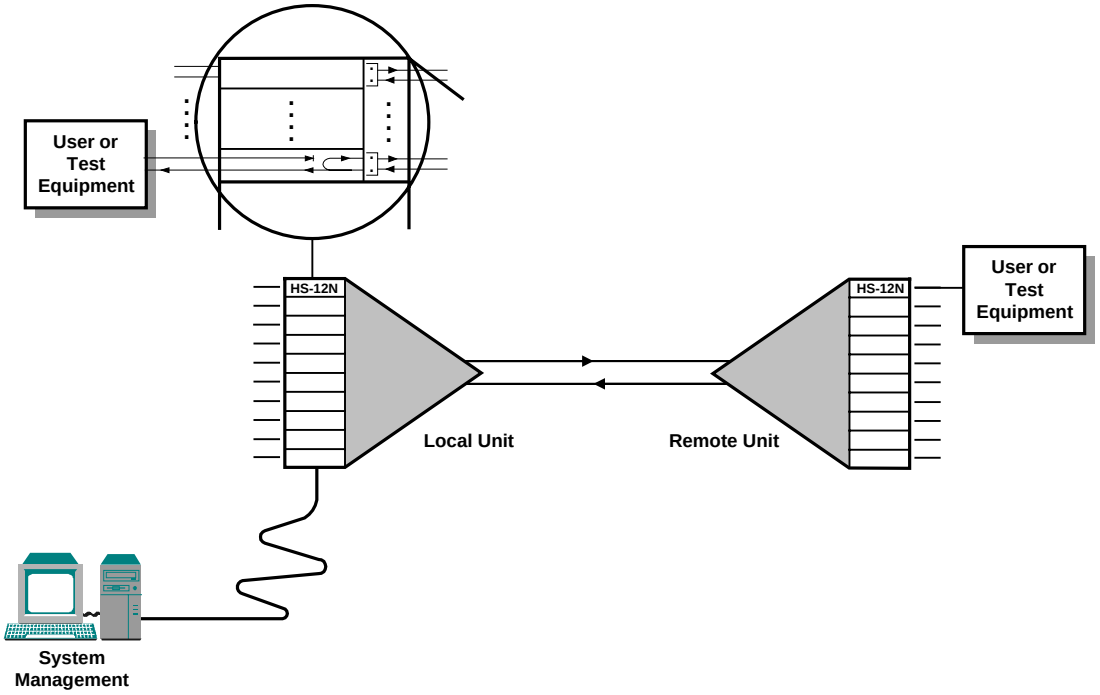


Figure 4-2. Remote Loopback, Signal Path

Bit Error Rate Testing (BERT)

The BERT is used to check for proper data transmission through a selected channel, and obtain a qualitative evaluation of data transmission without using external test equipment. At any given time, BER testing can be performed on only one channel of the HS-6N/12N module.

During this test, the local BER system is connected to the corresponding local channel, as shown in *Figure 4-3*. To return the test pattern to the test sequence evaluator, the user activates a loopback at the desired location.

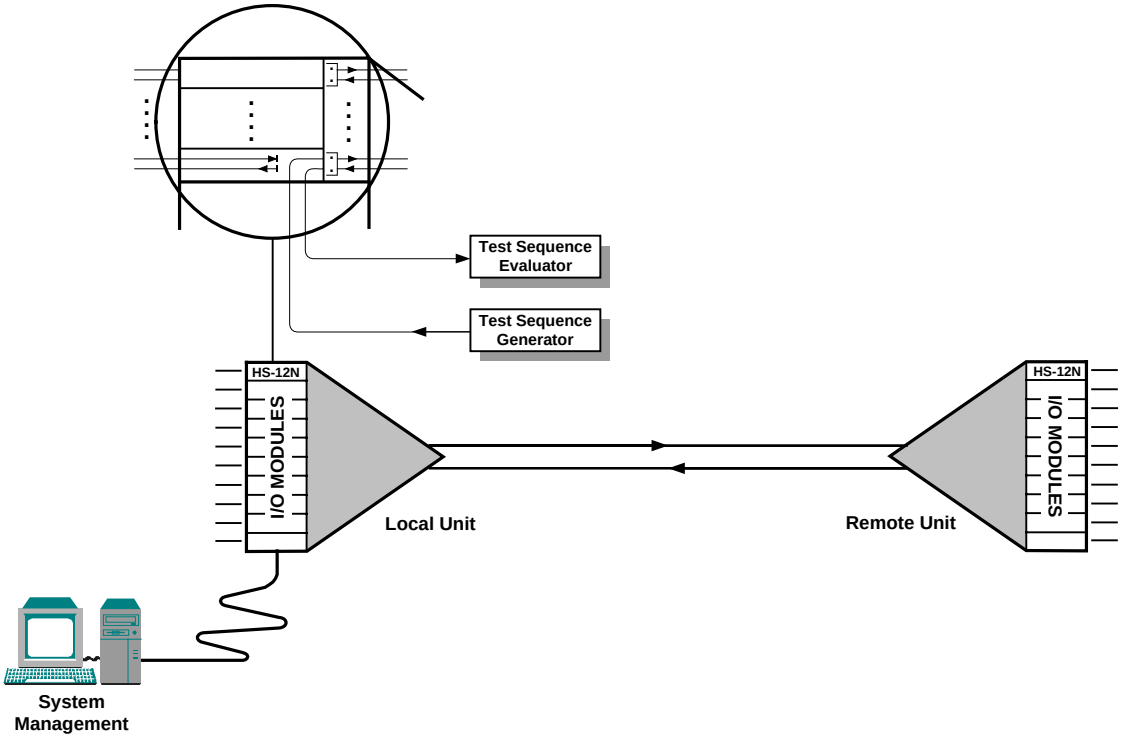


Figure 4-3. BERT Signal Path

The bit error rate is measured by applying an RJ-011 test sequence generated by an on-board generator to the input of the transmit path. The transmitted data is returned by means of a loopback somewhere along the data path (e.g., by connecting a local or remote main link loopback) to the receive path of the module, and routed to a test sequence evaluator.

Instead of using a loopback, it is also possible to activate the BERT at both ends of the link, because the same data patterns are used at both ends. The evaluator compares the received data, bit by bit, to the original data and detects any difference (bit error). The output of the evaluator is sampled during module polling, to check whether errors were detected in the interval between consecutive pollings.

The user can read the accumulated test time and the number of errors detected since the test has been started. For convenience, the user can also clear the accumulated results without interrupting the test.

During the BERT, the channel is disconnected from the user data equipment.

Note

The BER test is not supported by the MP-4100 chassis.

Recommended Test Sequence

The loops available on the HS-6N/12N module provide a rapid and efficient way to identify the general location of a fault at either in a HS-6N/12N module, or in the external equipment or connections to channels.

Note

When the problem is detected when a new connection is activated for the first time, before starting the troubleshooting procedure described below thoroughly check the timeslot allocation, the configuration of the two Megaplex units that provide the new connection, and the configuration of the module and the equipment connected to the module channel.

If a complaint is received from one of the users connected to a HS-6N/12N module, first activate the HS-6N/12N local loopback at the side the complaint is received from. The local user must receive its own signal. If the signal is not received, the problem is at the local end:

- Check the connections to the user equipment, or the user's equipment itself.
- Replace the cable.
- Replace the local HS-6N/12N module.

If the local subscriber receives its own signal when the local loopback is connected, activate the remote loopback and repeat the check. You may also perform BER testing, to confirm the proper operation of the transmission path.

If the remote loopback and BER test indicate the link operates normally, the problem is at the remote end. To check, repeat the procedure on the remote Megaplex unit.

4.2 Frequently Asked Questions

Q: When installed in the MP-4100 chassis, do the HS-6N, HS-12N modules operate exactly the same as when installed in the MP-2100/2104 chassis?

A: Yes, they do. All the differences between the two module locations are purely chassis/common logic related (command line vs menu interface, main link vs CLX or I/O ports as timeslot destinations, etc.) The main module-level difference is that the bidirectional broadcast modes (BID-BRD RX and BID-BRD RING) are not available for the module operating in the Megaplex-4100 chassis. Also, the MP-4100 chassis does not support the BER test.

4.3 Technical Support

Technical support for this product can be obtained from the local distributor from whom it was purchased.

For further information, please contact the RAD distributor nearest you or one of RAD's offices worldwide. This information can be found at www.rad.com (offices – About RAD › Worldwide Offices; distributors – Where to Buy › End Users).

Appendix A
Pinouts

A.1 SCSI Connector Pinout

The user's equipment is connected to HS-12N modules via 68-pin SCSI female connectors designated CH. 1-3, CH. 4-6, CH. 7-9, CH. 10-12. For HS-6N modules, only the CH. 1-3 and CH. 4-6 connectors are used.

Table A-1 lists the pin assignment of the CH connectors. Note that the pins in actual use depend on the module version.

Table A-1. CH Connector, Pin Assignment

Channel	Pin	Designation	Function	Pin	Designation	Function
–	1	F.G.	Frame Ground	35	S.G.	Signal Ground
1, 4, 7, 10	2	RD(A)	Receive Data A	36	RD(B)	Receive Data B
	3	TC(A)	Transmit Clock A	37	TC(B)	Transmit Clock B
	4	RC(A)	Receive Clock A	38	RC(B)	Receive Clock B
	5	ERC(A)	External Receive Clock A	39	ERC(B)	External Receive Clock B
	6	ETC(A)	External Transmit Clock A	40	ETC(B)	External Transmit Clock B
	7	TD(A)	Transmit Data A	41	TD(B)	Transmit Data B
	8	CO(A)	Control Out A	42	CO(B)	Control Out B
	9	DSR(A)	Data Set Ready A	43	DSR(B)	Data Set Ready B
	10	DCD(A)	Data Carrier Detect A	44	DCD(B)	Data Carrier Detect B
	11	CI(A)	Control In A	45	CI(B)	Control In B
	12	F.G	Frame Ground	46	S.G	Signal Ground
2, 5, 8, 11	13	RD(A)	Receive Data A	47	RD(B)	Receive Data B
	14	TC(A)	Transmit Clock A	48	TC(B)	Transmit Clock B
	15	RC(A)	Receive Clock A	49	RC(B)	Receive Clock B
	16	ERC(A)	External Receive Clock A	50	ERC(B)	External Receive Clock B
	17	ETC(A)	External Transmit Clock A	51	ETC(B)	External Transmit Clock B
	18	TD(A)	Transmit Data A	52	TD(B)	Transmit Data B
	19	CO(A)	Control Out A	53	CO(B)	Control Out B
	20	DSR(A)	Data Set Ready A	54	DSR(B)	Data Set Ready B
	21	DCD(A)	Data Carrier Detect A	55	DCD(B)	Data Carrier Detect B
	22	CI(A)	Control In A	56	CI(B)	Control In B
	23	F.G	Frame Ground	57	S.G	Signal Ground

Table A-1. CH Connector, Pin Assignment (Cont.)

Channel	Pin	Designation	Function	Pin	Designation	Function
3, 6, 9, 12	24	RD(A)	Receive Data A	58	RD(B)	Receive Data B
	25	TC(A)	Transmit Clock A	59	TC(B)	Transmit Clock B
	26	RC(A)	Receive Clock A	60	RC(B)	Receive Clock B
	27	ERC(A)	External Receive Clock A	61	ERC(B)	External Receive Clock B
	28	ETC(A)	External Transmit Clock A	62	ETC(B)	External Transmit Clock B
	29	TD(A)	Transmit Data A	63	TD(B)	Transmit Data B
	30	CO(A)	Control Out A	64	CO(B)	Control Out B
	31	DSR(A)	Data Set Ready A	65	DSR(B)	Data Set Ready B
	32	DCD(A)	Data Carrier Detect A	66	DCD(B)	Data Carrier Detect B
	33	CI(A)	Control In A	67	CI(B)	Control In B
	34	F.G	Frame Ground	68	S.G	Signal Ground

A.2 Adapter Cables

RAD offers adapter cables for directly connecting user's equipment with standard connectors to the appropriate 68-pin SCSI-4 connector located on the HS-6N/12N module. *Table A-2* provides information on the adapter cables available from RAD. Wiring information on each cable is provided in the following sections.

Table A-2. Adapter Cables Offered by RAD

Module Version	Adapter Cable	User's Side Connectors
V.35	CBL-SCS68/3/V35/M	34-pin VAPL male connector
RS-422	CBL-SCS68/3/530/M	25-pin D-type male connector
	CBL-SCS68/3/X21/M	15-pin D-type male connector
	CBL-SCS68/3/V36/M	37-pin D-type male connector
	CBL-SCS68/3/V36/F	37-pin D-type female connector
RS-232	CBL-SCS68/3/232/M	25-pin D-type male connector

The user side of each cable is terminated in three connectors, designated CH-1, CH-2, CH-3. The tables in the following sections list the pinout of each connector on the HS-6N, HS-12N and user sides and indicate the number of HS-6N, HS-12N channel corresponding to each pin.

CBL-SCS68/3/V35/M Cable

Figure A-1 shows a general view of the CBL-SCS68/3/V35/M cable, and *Table A-3* lists the cable wiring.

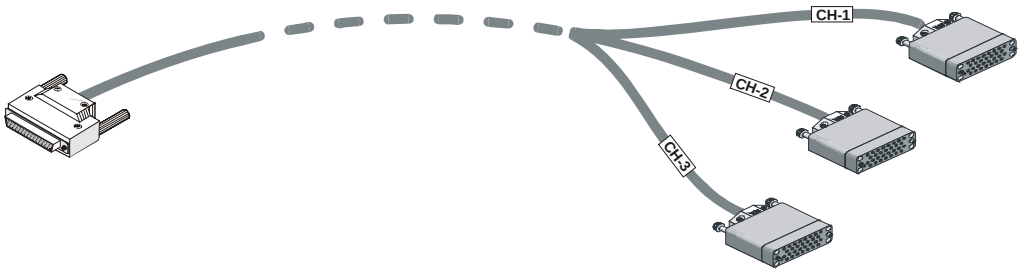


Figure A-1. CBL-SCS68/3/V35/M Cable

Table A-3. CBL-SCS68/3/V35/M, Cable Wiring

Ch	SCSI Connector		Function	34-Pin Connector	SCSI Connector		Function	34-Pin Connector
	1	F.G.	Not Used		35	S.G.	Not Used	
1, 4, 7, 10	2	RD(A)	Receive Data A	R	36	RD(B)	Receive Data B	T
	3	TC(A)	Transmit Clock A	Y	37	TC(B)	Transmit Clock B	AA
	4	RC(A)	Receive Clock A	V	38	RC(B)	Receive Clock B	X
	5	ERC(A)	External Receive Clock A	BB	39	ERC(B)	External Receive Clock B	Z
	6	ETC(A)	External Transmit Clock A	U	40	ETC(B)	External Transmit Clock B	W
	7	TD(A)	Transmit Data A	P	41	TD(B)	Transmit Data B	S
	8	CO	Control Out	D	42	–	Not Used	
	9	DSR	Data Set Ready	E	43	–	Not Used	
	10	DCD	Data Carrier Detect	F	44	–	Not Used	
	11	CI	Control In	C	45	–	Not Used	
	12	F.G	Frame Ground	A	46	S.G	Signal Ground	B
2, 5, 8, 11	13	RD(A)	Receive Data A	R	47	RD(B)	Receive Data B	T
	14	TC(A)	Transmit Clock A	Y	48	TC(B)	Transmit Clock B	AA
	15	RC(A)	Receive Clock A	V	49	RC(B)	Receive Clock B	X
	16	ERC(A)	External Receive Clock A	BB	50	ERC(B)	External Receive Clock B	Z
	17	ETC(A)	External Transmit Clock A	U	51	ETC(B)	External Transmit Clock B	W
	18	TD(A)	Transmit Data A	P	52	TD(B)	Transmit Data B	S
	19	CO	Control Out	D	53	–	Not Used	
	20	DSR	Data Set Ready	E	54	–	Not Used	
	21	DCD	Data Carrier Detect	F	55	–	Not Used	
	22	CI	Control In	C	56	–	Not Used	
	23	F.G	Frame Ground	A	57	S.G	Signal Ground	B

Table A-3. CBL-SCS68/3/V35/M Cable Wiring (Cont.)

Ch	SCSI Connector		Function	34-Pin Connector	SCSI Connector		Function	34-Pin Connector
3, 6, 9, 12	24	RD(A)	Receive Data A	R	58	RD(B)	Receive Data B	T
	25	TC(A)	Transmit Clock A	Y	59	TC(B)	Transmit Clock B	AA
	26	RC(A)	Receive Clock A	V	60	RC(B)	Receive Clock B	X
	27	ERC(A)	External Receive Clock A	BB	61	ERC(B)	External Receive Clock B	Z
	28	ETC(A)	External Transmit Clock A	U	62	ETC(B)	External Transmit Clock B	W
	29	TD(A)	Transmit Data A	P	63	TD(B)	Transmit Data B	S
	30	CO	Control Out	D	64	–	Not Used	
	31	DSR	Data Set Ready	E	65	–	Not Used	
	32	DCD	Data Carrier Detect	F	66	–	Not Used	
	33	CI	Control In	C	67	–	Not Used	
	34	F.G	Frame Ground	A	68	S.G	Signal Ground	B

CBL-SCS68/3/530/M Cable

*Figure A-2 s*hows a general view of the CBL-SCS68/3/530/M cable, and *Table A-4* lists the cable wiring.

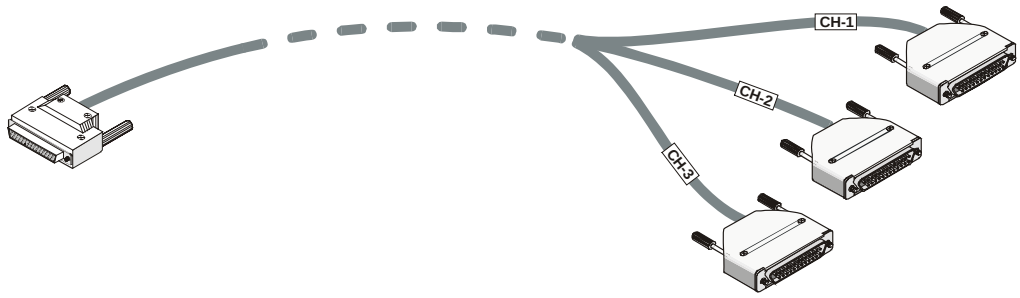


Figure A-2. CBL-SCS68/3/530/M Cable

Table A-4. CBL-SCS68/3/530/M Cable Wiring

Ch	SCSI Connector		Function	25-Pin Connector	SCSI Connector		Function	25-Pin Connector
	1	F.G.	Not Used		35	S.G.	Not Used	
1, 4, 7, 10	2	RD(A)	Receive Data A	3	36	RD(B)	Receive Data B	16
	3	TC(A)	Transmit Clock A	15	37	TC(B)	Transmit Clock B	12
	4	RC(A)	Receive Clock A	17	38	RC(B)	Receive Clock B	9
	5	ERC(A)	External Receive Clock A	20	39	ERC(B)	External Receive Clock B	23
	6	ETC(A)	External Transmit Clock A	24	40	ETC(B)	External Transmit Clock B	11

Table A-4. CBL-SCS68/3/530/M Cable Wiring (Cont.)

Ch	SCSI Connector		Function	25-Pin Connector	SCSI Connector		Function	25-Pin Connector
	7	TD(A)	Transmit Data A	2	41	TD(B)	Transmit Data B	14
	8	CO(A)	Control Out A	5	42	CO(B)	Control Out B	13
	9	DSR(A)	Data Set Ready A	6	43	DSR(B)	Data Set Ready B	22
	10	DCD(A)	Data Carrier Detect A	8	44	DCD(B)	Data Carrier Detect B	10
	11	CI(A)	Control In A	4	45	CI(B)	Control In B	19
	12	F.G	Frame Ground	1	46	S.G	Signal Ground	7
	13	RD(A)	Receive Data A	3	47	RD(B)	Receive Data B	16
	14	TC(A)	Transmit Clock A	15	48	TC(B)	Transmit Clock B	12
	15	RC(A)	Receive Clock A	17	49	RC(B)	Receive Clock B	9
	16	ERC(A)	External Receive Clock A	20	50	ERC(B)	External Receive Clock B	23
2, 5, 8, 11	17	ETC(A)	External Transmit Clock A	24	51	ETC(B)	External Transmit Clock B	11
	18	TD(A)	Transmit Data A	2	52	TD(B)	Transmit Data B	14
	19	CO(A)	Control Out A	5	53	CO(B)	Control Out B	13
	20	DSR(A)	Data Set Ready A	6	54	DSR(B)	Data Set Ready B	22
	21	DCD(A)	Data Carrier Detect A	8	55	DCD(B)	Data Carrier Detect B	10
	22	CI(A)	Control In A	4	56	CI(B)	Control In B	19
	23	F.G	Frame Ground	1	57	S.G	Signal Ground	7
	24	RD(A)	Receive Data A	3	58	RD(B)	Receive Data B	16
	25	TC(A)	Transmit Clock A	15	59	TC(B)	Transmit Clock B	12
	26	RC(A)	Receive Clock A	17	60	RC(B)	Receive Clock B	9
	27	ERC(A)	External Receive Clock A	20	61	ERC(B)	External Receive Clock B	23
3, 6, 9, 12	28	ETC(A)	External Transmit Clock A	24	62	ETC(B)	External Transmit Clock B	11
	29	TD(A)	Transmit Data A	2	63	TD(B)	Transmit Data B	14
	30	CO(A)	Control Out A	5	64	CO(B)	Control Out B	13
	31	DSR(A)	Data Set Ready A	6	65	DSR(B)	Data Set Ready B	22
	32	DCD(A)	Data Carrier Detect A	8	66	DCD(B)	Data Carrier Detect B	10
	33	CI(A)	Control In A	4	67	CI(B)	Control In B	19
	34	F.G	Frame Ground	1	68	S.G	Signal Ground	7

CBL-SCS68/3/X21/M Cable

*Figure A-3 s*hows a general view of the CBL-SCS68/3/X21/M cable, and *Table A-5* lists the cable wiring.

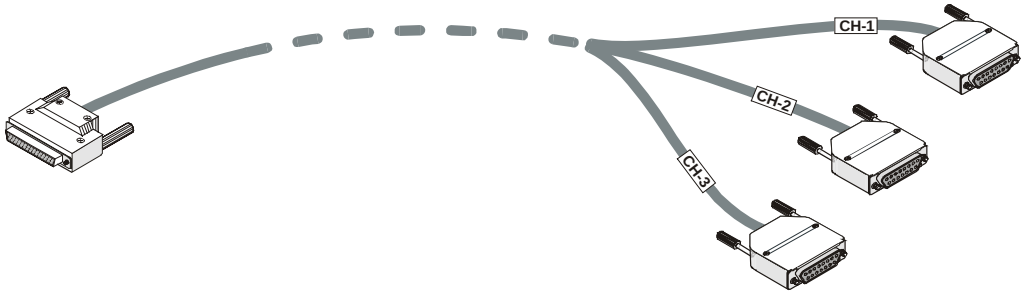


Figure A-3. CBL-SCS68/3/X21/M Cable, General View

Table A-5. CBL-SCS68/3/X21/M Cable Wiring

Ch	SCSI Connector		Function	15-Pin Connector	SCSI Connector		Function	15-Pin Connector
	1	F.G.	Not Used		35	S.G.	Not Used	
1, 4, 7, 10	2	RD(A)	Receive Data A	4	36	RD(B)	Receive Data B	11
	3	TC(A)	Transmit Clock A	6	37	TC(B)	Transmit Clock B	13
	4	–	Not Used		38	–	Not Used	
	5	ETC(A)	External Transmit Clock A	7	39	ETC(B)	External Transmit Clock B	14
	6	ETC(A)	External Transmit Clock A	7	40	ETC(B)	External Transmit Clock B	14
	7	TD(A)	Transmit Data A	2	41	TD(B)	Transmit Data B	9
	8	–	Not Used		42	–	Not Used	
	9	–	Not Used		43	–	Not Used	
	10	DCD(A)	Data Carrier Detect A	5	44	DCD(B)	Data Carrier Detect B	12
	11	CI(A)	Control In A	3	45	CI(B)	Control In B	10
	12	F.G	Frame Ground	1	46	S.G	Signal Ground	8

Table A-5. CBL-SCS68/3/X21/M Cable Wiring (Cont.)

Ch	SCSI Connector		Function	15-Pin Connector	SCSI Connector		Function	15-Pin Connector
2, 5, 8, 11	13	RD(A)	Receive Data A	4	47	RD(B)	Receive Data B	11
	14	TC(A)	Transmit Clock A	6	48	TC(B)	Transmit Clock B	13
	15	–	Not Used		49	–	Not Used	
	16	ETC(A)	External Transmit Clock A	7	50	ETC(B)	External Transmit Clock B	14
	17	ETC(A)	External Transmit Clock A	7	51	ETC(B)	External Transmit Clock B	14
	18	TD(A)	Transmit Data A	2	52	TD(B)	Transmit Data B	9
	19	–	Not Used		53	–	Not Used	
	20	–	Not Used		54	–	Not Used	
	21	DCD(A)	Data Carrier Detect A	5	55	DCD(B)	Data Carrier Detect B	12
	22	CI(A)	Control In A	3	56	CI(B)	Control In B	10
	23	F.G	Frame Ground	1	57	S.G	Signal Ground	8
3, 6, 9, 12	24	RD(A)	Receive Data A	4	58	RD(B)	Receive Data B	11
	25	TC(A)	Transmit Clock A	6	59	TC(B)	Transmit Clock B	13
	26	–	Not Used		60	–	Not Used	
	27	ETC(A)	External Transmit Clock A	7	61	ETC(B)	External Transmit Clock B	14
	28	ETC(A)	External Transmit Clock A	7	62	ETC(B)	External Transmit Clock B	14
	29	TD(A)	Transmit Data A	2	63	TD(B)	Transmit Data B	9
	30	–	Not Used		64	–	Not Used	
	31	–	Not Used		65	–	Not Used	
	32	DCD(A)	Data Carrier Detect A	5	66	DCD(B)	Data Carrier Detect B	12
	33	CI(A)	Control In A	3	67	CI(B)	Control In B	10
	34	F.G	Frame Ground	1	68	S.G	Signal Ground	8

CBL-SCS68/3/V36/M and CBL-SCS68/3/V36/F Cables

*Figure A-4 s*hows general views of the CBL-SCS68/3/V36/M and CBL-SCS68/3/V36/F cables, and *Table A-6* lists the cable wiring.

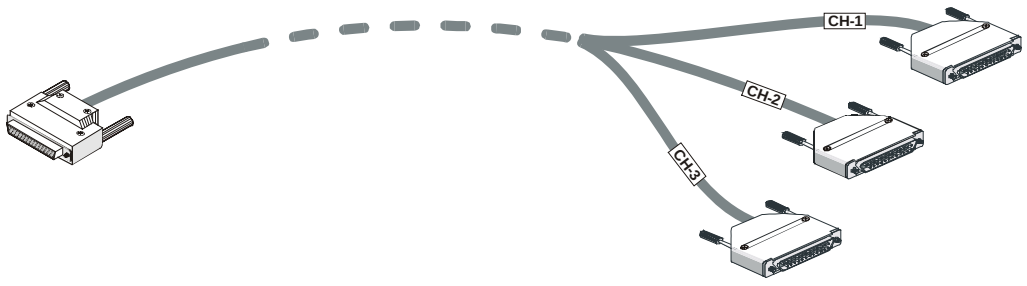


Figure A-4. CBL-SCS68/3/V36/M, CBL-SCS68/3/V36/F Cables

Table A-6. CBL-SCS68/3/V36/M, CBL-SCS68/3/V36/F Cable Wiring

Ch	SCSI Connector		Function	37-Pin Connector	SCSI Connector		Function	37-Pin Connector
	1	F.G.	Not Used		35	S.G.	Not Used	
1, 4, 7, 10	2	RD(A)	Receive Data A	6	36	RD(B)	Receive Data B	24
	3	TC(A)	Transmit Clock A	5	37	TC(B)	Transmit Clock B	23
	4	RC(A)	Receive Clock A	8	38	RC(B)	Receive Clock B	26
	5	ERC(A)	External Receive Clock A	12	39	ERC(B)	External Receive Clock B	30
	6	ETC(A)	External Transmit Clock A	17	40	ETC(B)	External Transmit Clock B	35
	7	TD(A)	Transmit Data A	4	41	TD(B)	Transmit Data B	22
	8	CO(A)	Control Out A	9	42	CO(B)	Control Out B	27
	9	DSR(A)	Data Set Ready A	11	43	DSR(B)	Data Set Ready B	29
	10	DCD(A)	Data Carrier Detect A	13	44	DCD(B)	Data Carrier Detect B	31
	11	CI(A)	Control In A	7	45	CI(B)	Control In B	25
	12	F.G	Frame Ground	1	46	S.G	Signal Ground	19, 20, 37

Table A-6. CBL-SCS68/3/V36/M, CBL-SCS68/3/V36/F Cable Wiring (Cont.)

Ch	SCSI Connector		Function	37-Pin Connector	SCSI Connector		Function	37-Pin Connector
2, 5, 8, 11	13	RD(A)	Receive Data A	6	47	RD(B)	Receive Data B	24
	14	TC(A)	Transmit Clock A	5	48	TC(B)	Transmit Clock B	23
	15	RC(A)	Receive Clock A	8	49	RC(B)	Receive Clock B	26
	16	ERC(A)	External Receive Clock A	12	50	ERC(B)	External Receive Clock B	30
	17	ETC(A)	External Transmit Clock A	17	51	ETC(B)	External Transmit Clock B	35
	18	TD(A)	Transmit Data A	4	52	TD(B)	Transmit Data B	22
	19	CO(A)	Control Out A	9	53	CO(B)	Control Out B	27
	20	DSR(A)	Data Set Ready A	11	54	DSR(B)	Data Set Ready B	29
	21	DCD(A)	Data Carrier Detect A	13	55	DCD(B)	Data Carrier Detect B	31
	22	CI(A)	Control In A	7	56	CI(B)	Control In B	25
	23	F.G	Frame Ground	1	57	S.G	Signal Ground	19, 20, 37
3, 6, 9, 12	24	RD(A)	Receive Data A	6	58	RD(B)	Receive Data B	24
	25	TC(A)	Transmit Clock A	5	59	TC(B)	Transmit Clock B	23
	26	RC(A)	Receive Clock A	8	60	RC(B)	Receive Clock B	26
	27	ERC(A)	External Receive Clock A	12	61	ERC(B)	External Receive Clock B	30
	28	ETC(A)	External Transmit Clock A	17	62	ETC(B)	External Transmit Clock B	35
	29	TD(A)	Transmit Data A	4	63	TD(B)	Transmit Data B	22
	30	CO(A)	Control Out A	9	64	CO(B)	Control Out B	27
	31	DSR(A)	Data Set Ready A	11	65	DSR(B)	Data Set Ready B	29
	32	DCD(A)	Data Carrier Detect A	13	66	DCD(B)	Data Carrier Detect B	31
	33	CI(A)	Control In A	7	67	CI(B)	Control In B	25
	34	F.G	Frame Ground	1	68	S.G	Signal Ground	19, 20, 37

CBL-SCS68/3/232/M Cable

*Figure A-5 s*hows a general view of the CBL-SCS68/3/232/M cable, and *Table A-7* lists the cable wiring.

Figure A-5. CBL-SCS68/3/232/M Cable

Table A-7. CBL-SCS68/3/232/M Cable Wiring

Ch	SCSI Connector		Function	25-Pin Connector	SCSI Connector		Function	25-Pin Connector
	1	F.G.	Frame Ground	1	35	S.G.	Signal Ground	7
1, 4, 7, 10	2	RD(A)	Receive Data A	3	36	–	Not Used	
	3	TC(A)	Transmit Clock A	15	37	–	Not Used	
	4	RC(A)	Receive Clock A	17	38	–	Not Used	
	5	ERC(A)	External Receive Clock	20	39	–	Not Used	
	6	ETC(A)	External Transmit Clock	24	40	–	Not Used	
	7	TD(A)	Transmit Data	2	41	–	Not Used	
	8	CO(A)	Control Out	5	42	–	Not Used	
	9	DSR(A)	Data Set Ready	6	43	–	Not Used	
	10	DCD(A)	Data Carrier Detect	8	44	–	Not Used	
	11	CI(A)	Control In A	4	45	–	Not Used	
	12	F.G	Frame Ground	1	46	S.G	Signal Ground	7
2, 5, 8, 11	13	RD(A)	Receive Data	3	47	–	Not Used	
	14	TC(A)	Transmit Clock	15	48	–	Not Used	
	15	RC(A)	Receive Clock	17	49	–	Not Used	
	16	ERC(A)	External Receive Clock	20	50	–	Not Used	
	17	ETC(A)	External Transmit Clock	24	51	–	Not Used	
	18	TD(A)	Transmit Data	2	52	–	Not Used	
	19	CO(A)	Control Out	5	53	–	Not Used	
	20	DSR(A)	Data Set Ready	6	54	–	Not Used	
	21	DCD(A)	Data Carrier Detect	8	55	–	Not Used	
	22	CI(A)	Control In	4	56	–	Not Used	
	23	F.G	Frame Ground	1	57	S.G	Signal Ground	7
3, 6, 9, 12	24	RD(A)	Receive Data	3	58	–	Not Used	
	25	TC(A)	Transmit Clock	15	59	–	Not Used	
	26	RC(A)	Receive Clock	17	60	–	Not Used	
	27	ERC(A)	External Receive Clock	20	61	–	Not Used	
	28	ETC(A)	External Transmit Clock	24	62	–	Not Used	
	29	TD(A)	Transmit Data	2	63	–	Not Used	
	30	CO(A)	Control Out	5	64	–	Not Used	
	31	DSR(A)	Data Set Ready	6	65	–	Not Used	
	32	DCD(A)	Data Carrier Detect	8	66	–	Not Used	
	33	CI(A)	Control In	4	67	–	Not Used	
	34	F.G	Frame Ground	1	68	S.G	Signal Ground	7

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Customer Response Form

RAD Data Communications would like your help in improving its product documentation. Please complete and return this form by mail or by fax or send us an e-mail with your comments.

Thank you for your assistance!

Manual Name: HS-6N, HS-12N

Publication Number: 764-248-10/07

Please grade the manual according to the following factors:

	Excellent	*Good*	*Fair*	*Poor*	*Very Poor*
Installation instructions	❒	❒	❒	❒	❒
Operating instructions	❒	❒	❒	❒	❒
Manual organization	❒	❒	❒	❒	❒
Illustrations	❒	❒	❒	❒	❒
The manual as a whole	❒	❒	❒	❒	❒

What did you like about the manual?

_____

_____

_____

_____

Error Report

Type of error(s) or problem(s):

- ❒ Incompatibility with product
- ❒ Difficulty in understanding text
- ❒ Regulatory information (Safety, Compliance, Warnings, etc.)
- ❒ Difficulty in finding needed information
- ❒ Missing information
- ❒ Illogical flow of information
- ❒ Style (spelling, grammar, references, etc.)
- ❒ Appearance
- ❒ Other _____

Please list the exact page numbers with the error(s), detail the errors you found (information missing, unclear or inadequately explained, etc.) and attach the page to your fax, if necessary.

_____

_____

_____

_____

Please add any comments or suggestions you may have.

_____

_____

_____

You are:

- ❒ Distributor
- ❒ End user
- ❒ VAR
- ❒ Other

Who is your distributor? _____

Your name and company: _____

Job title: _____

Address: _____

Direct telephone number and extension: _____

Fax number: _____

E-mail: _____

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